



Information Technology Infrastructure Committee (ITIC)

Report to the NAC

August 2013

Larry Smarr
Chair ITIC

ITIC Committee Members



Membership

- *Dr. Larry Smarr (Chair), Director- California Institute of Telecommunications and Information Technology, UC San Diego*
- *Dr. Charles Holmes (Vice-Chair), Retired- NASA HQ Heliophysics Program*
- *Dr. Robert Grossman, Professor- University of Chicago*
- *Hon. Mark Forman, former associate director of IT and e-government, OMB*
- *Mr. Joel Mambretti, Director, Intl. Center for Advanced Internet Research, NW Univ.*
- -----
- *Dr. Mark Boster; President-ImpaQ Solutions, LLC*
- *Dr. Alexander Szalay, Professor- Johns Hopkins University*
- *Mr. Alan Paller, Research Director- SANS Institute*
- *Dr. Ed Lazowska, Gates Professor & Chair , Dept of Computer Science, UWash*
- *Dr. Pete Beckman, Dir., Exascale Technology and Computing Institute, Argonne NL*
- *Mr. John Muratore, former NASA engineer & Program Manager, now with Space X*

- *Deborah Diaz (Exec Sec), Deputy CIO, NASA*

Finding #1



- ◆ **The U.S. government has issued several new guidance and directives on open data:**
 - OSTP February 22, 2013 Increasing Access to the Results of Federally Funded Scientific Research
 - OSTP March 29, 2013 Big Data is a Big Deal
 - Presidential Exec Order May 9, 2013 Open Data Policy-Managing Information as an Asset

EXECUTIVE OFFICE OF THE PRESIDENT OFFICE OF SCIENCE AND TECHNOLOGY POLICY



Washington DC 20502

February 22, 2013

- ◆ **“To achieve the Administration’s commitment to increase access to federally funded published research and digital scientific data, Federal agencies investing in research and development must have clear and coordinated policies for increasing such access.”**

- ◆ **“Each agency’s plan for both scientific publications and digital scientific data must contain:**
 - a strategy for improving the public’s ability to locate and access digital data resulting from federally funded scientific research;
 -(6 more bullets)”

Draft Plan
Due Aug 2013

White House Big Data Initiative



A screenshot of the White House website. At the top, the text "the WHITE HOUSE PRESIDENT BARACK OBAMA" is visible on the left, and "Get Email Updates" and "Contact Us" are on the right. Below this is a navigation bar with links for "BLOG", "PHOTOS & VIDEO", "BRIEFING ROOM", "ISSUES", "the ADMINISTRATION", "the WHITE HOUSE", and "our GOVERNMENT". The main content area has a blue header with "Office of Science and Technology Policy" and a search bar. Below the header is a secondary navigation bar with links for "About OSTP", "OSTP Blog", "Pressroom", "Divisions", "R&D Budgets", "Resource Library", "NSTC", "PCAST", and "Contact Us". The main article title is "Big Data is a Big Deal" in a large, dark red font. To the right of the title is a "Subscribe" button with a RSS icon. Below the title is the text "Posted by Tom Kalil on March 29, 2012 at 09:23 AM EDT". In the bottom right corner of the screenshot, there is a green button that says "GIVE FEEDBACK ABOUT THIS PAGE" with a speech bubble icon.

- National Science Foundation
- National Institutes of Health
- Department of Defense
- Department of Energy
- U.S. Geological Survey

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503



May 9, 2013

“Making information resources accessible, discoverable, and usable by the public can help fuel entrepreneurship, innovation, and scientific discovery-all of which improve Americans' lives and contribute significantly to job creation.”

“This Memorandum requires agencies to collect or create information in a way that supports downstream information processing and dissemination activities.”

NAC Committee on IT Infrastructure

DRAFT* Recommendation #2



UPDATE

March 8, 2012

- ◆ **Recommendation:** NASA should formally review the existing national data cyberinfrastructure supporting access to data repositories for NASA SMD missions. A comparison with best-of-breed practices within NASA and at other Federal agencies should be made.
- ◆ We request a briefing on this review to a joint meeting of the NAC IT Infrastructure, Science, and Education committees within one year of this recommendation. The briefing should contain recommendations for a NASA data-intensive cyberinfrastructure to support science discovery by both mission teams, remote researchers, and for education and public outreach appropriate to the growth driven by current and future SMD missions.

* To be completed after a joint meeting of ITIC, Science, and Education Committees in July 2012 and the final recommendation submitted to July 2012 NAC meeting

Science Committee Asked ITIC Chair to Brief Each of the Science Subcommittees



◆ ITIC Chair Had Interactive Briefings:

- Heliophysics October 11, 2012
- Astrophysics November 6, 2012
- Planetary April 5, 2013
- Earth Sciences April 11, 2013

◆ Each Subcommittee Provided Feedback to Science Committee Chair

NAC Committee on IT Infrastructure Recommendation #1



- ◆ **Recommendation:** The NASA NAC ITIC & Science Committees should collaboratively explore the existing and planned evolution of NASA's science data cyberinfrastructure that supports broad access to data repositories for NASA SMD missions. This exploration should be undertaken in the context of effective practices within NASA, other Federal agencies, as well as industry and research institutions.

**Wording Agreed to by Both ITIC and Science Committees
July 31, 2013**



HBR Blog Network



Today's CIO Needs to Be the Chief Innovation Officer

by Daniel Burrus | 11:00 AM July 30, 2013



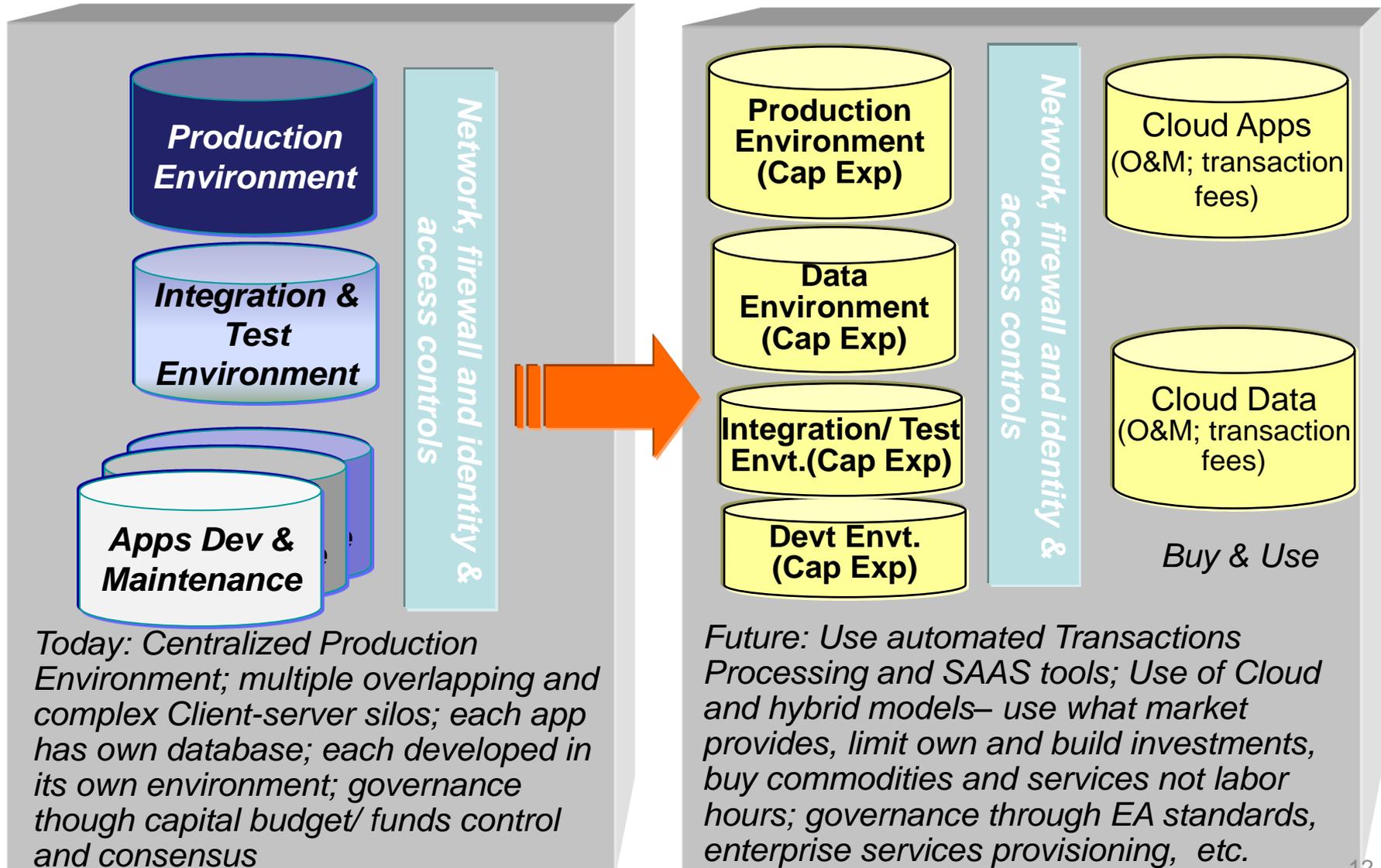
CIO role in IT Governance Models:

Heart of Debate: Organization versus Process

- ◆ **Clinger Cohen Act of 1996:** CIO responsible for business transformation and proper use of IT by their agency; Agency head accountable for empowering CIO; CIO as direct report; Funds control via capital budgeting
- ◆ **Bush E-Government and President's Management Agenda, E-Gov Act of 2002, and Federal Information Security Management Act (2002):** Agencies graded on performance (project management, modernization blueprint focus on core performance issues, cyber security, business cases, effective participation in enterprise/cross agency initiatives)
- ◆ **Obama 25 point plan, Digital Government Strategy (May 23, 2012), PortfolioStat Guidance (OMB M-13-09), and CIO Authorities (OMB M-11- 29)** CIO as chief agency IT guru focused on IT infrastructure and project management improvements (e.g. fewer failed projects, faster results, data center consolidation), responsible for terminating or fixing poor performing projects, responsible for consolidating hw/sw purchases and data centers using commodity IT, and Bureau CIOs focus on Apps;
- ◆ **Federal IT Acquisition Reform Act (FITARA) as passed by House June 2013:** Similar with FITARA, but CIO has more funds control and Bureau CIOs are consolidated under agency CIO and only agency CIO can have a CIO title, CIO responsible for all hw/sw commodity IT



Background: CIO Governance Issues Are Becoming More Complex as **the Highly Customized Client Server Era Ends**



Source: Mark Forman, NAC ITIC

ITIC Has Good Discussions with CIO Team



**Larry Sweet,
NASA CIO**



**Deborah Diaz,
NASA Deputy CIO**

NAC Committee on IT Infrastructure Recommendation #2



- ◆ **Recommendation:**
- ◆ NASA should produce a clear and concise IT governance document, including documented processes, policies, and organization roles and responsibilities. The framework should incorporate leading IT governance methods.
- ◆ We suggest the Administrator then issue a public memorandum that articulates the performance objectives, role, responsibilities, and authorities of the Chief Information Officer.

NAC Committee on IT Infrastructure Recommendation #2 (Continued)



◆ Major Reasons for the Recommendation:

- ◆ Clarifies expectations and roles of CIO with buy-in from the mission directorates.
- ◆ Provide clear corporate responsibilities for the growing role of IT in mission development and successes
- ◆ Administration guidance is shifting:
 - Focus on oversight of IT projects and procurement of commodity IT software, equipment, and services to be applied across the Agency.

◆ Consequences of No Action on the Recommendation:

- ◆ NASA continues to be criticized from oversight organizations in the Administration and Congress.
- ◆ Development of “highly specialized Mission IT” will miss opportunities to leverage from NASA-wide IT developments.

SpaceX IT Governance as a Contrasting Model



Garrett Reisman on the mid-deck of
Space Shuttle Endeavour during STS-123

My Tour Led by former NASA Astronaut Garrett Reisman
Now SpaceX Dragon Astronaut-Manager

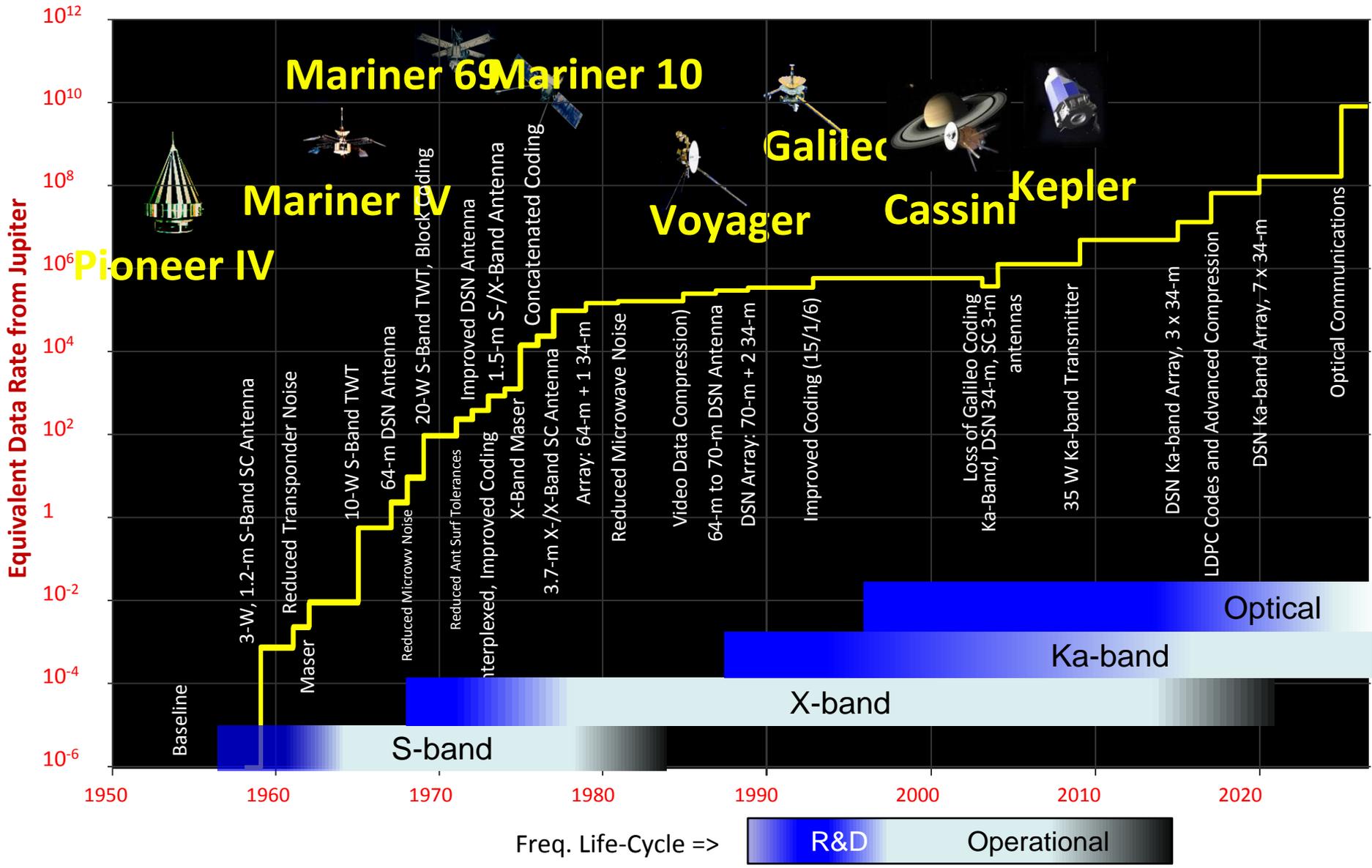


**NASA Advisory Council ITIC Committee
Space Communications and Navigation
Optical Communications Update**

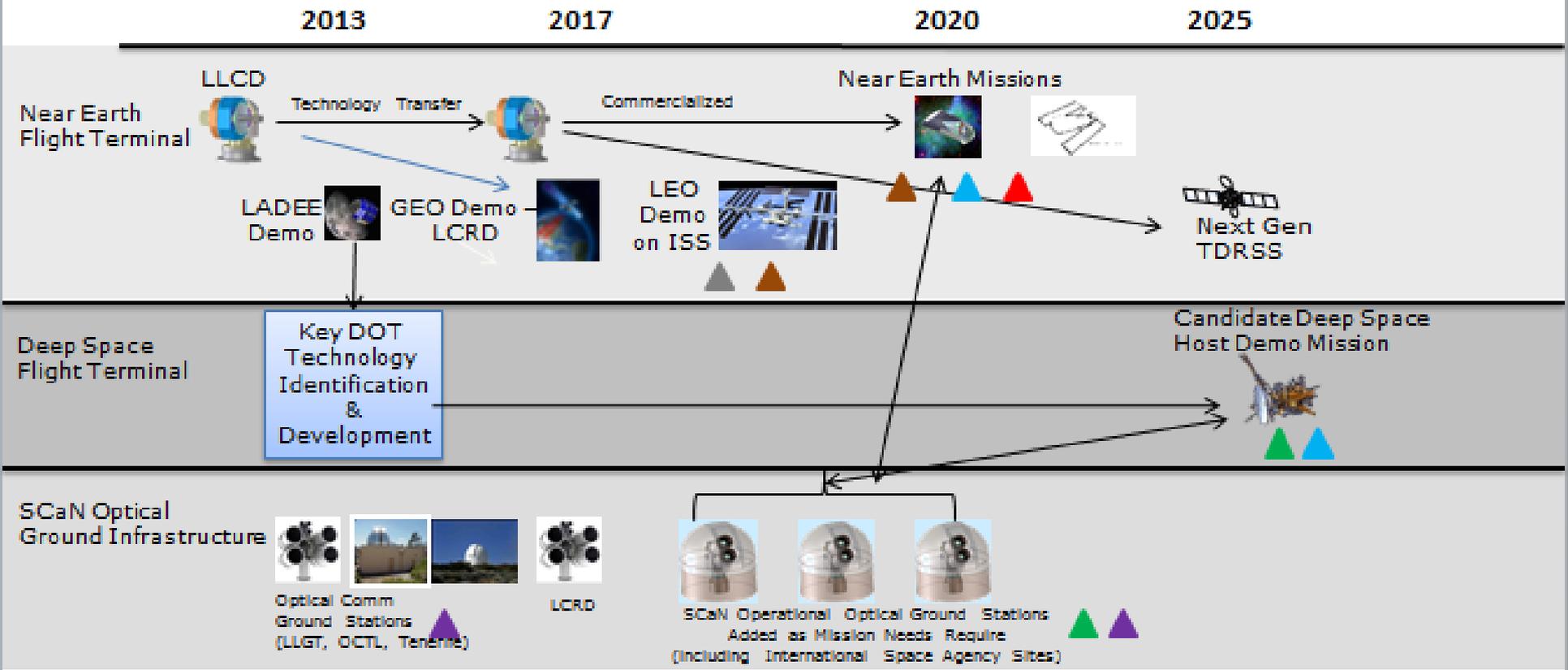
**John Rush
July 30, 2013**



Example Deep Space Communications Data Rate Evolution

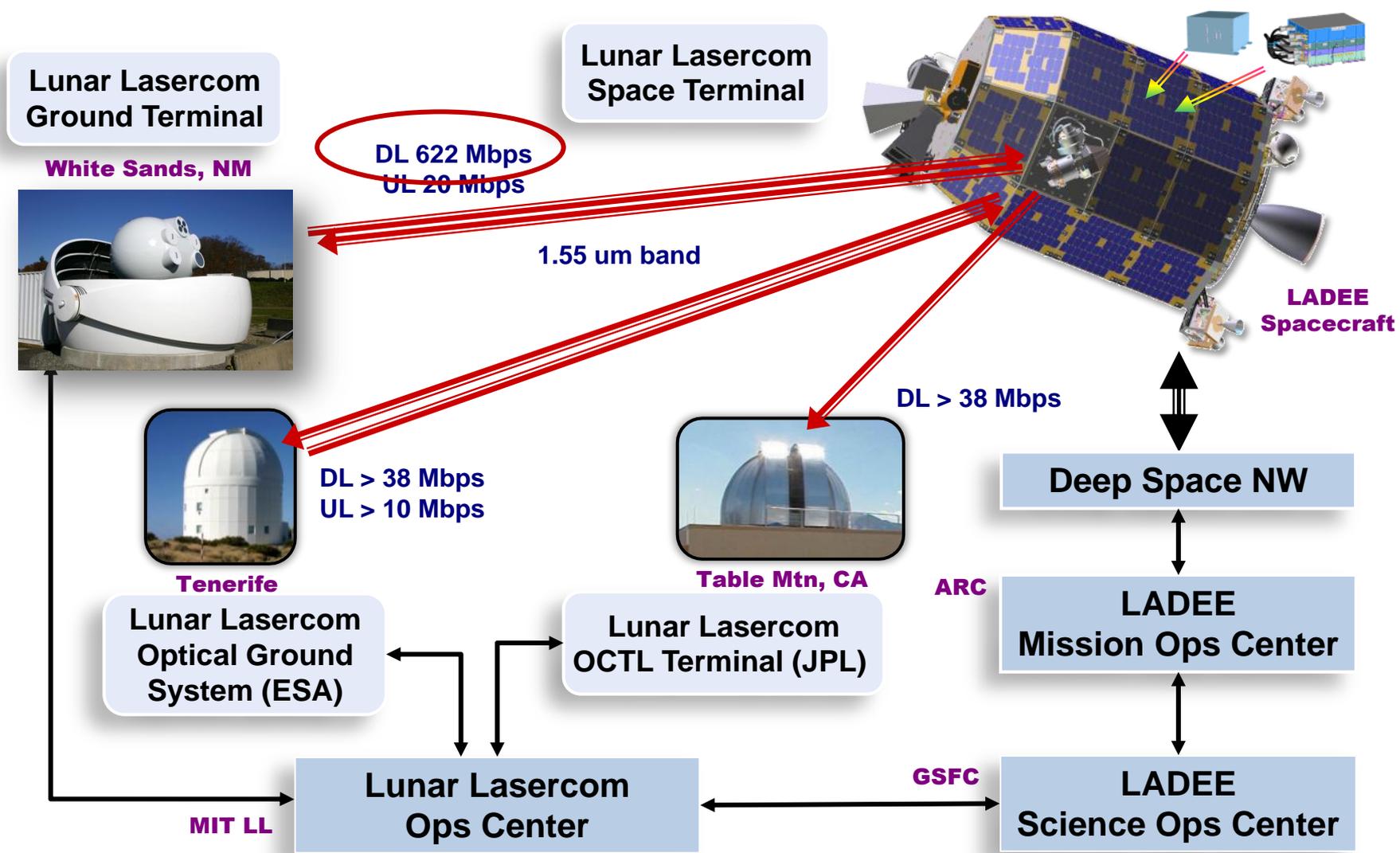


NASA Optical Communication Technology Strategy





Lunar Laser Communication Demonstration



- Launch Readiness Date – September 6
- Begin Optical Communications Experiment – October 6
- End of LADEE Mission – March 2014



◆ Goals for ISS Demo:

- Serve as a fully operational LEO satellite to LCRD relay
- Incorporate design improvements from the LEO Technology Study to build a high bandwidth, operational space-to-ground optical link
- Return link (to Earth): up to 1.25 Gigabits/second
- Forward link (to ISS): up to **250 Megabits/second**
- Robust pointing, acquisition, tracking to GEO relay from the ISS JEM-EF platform



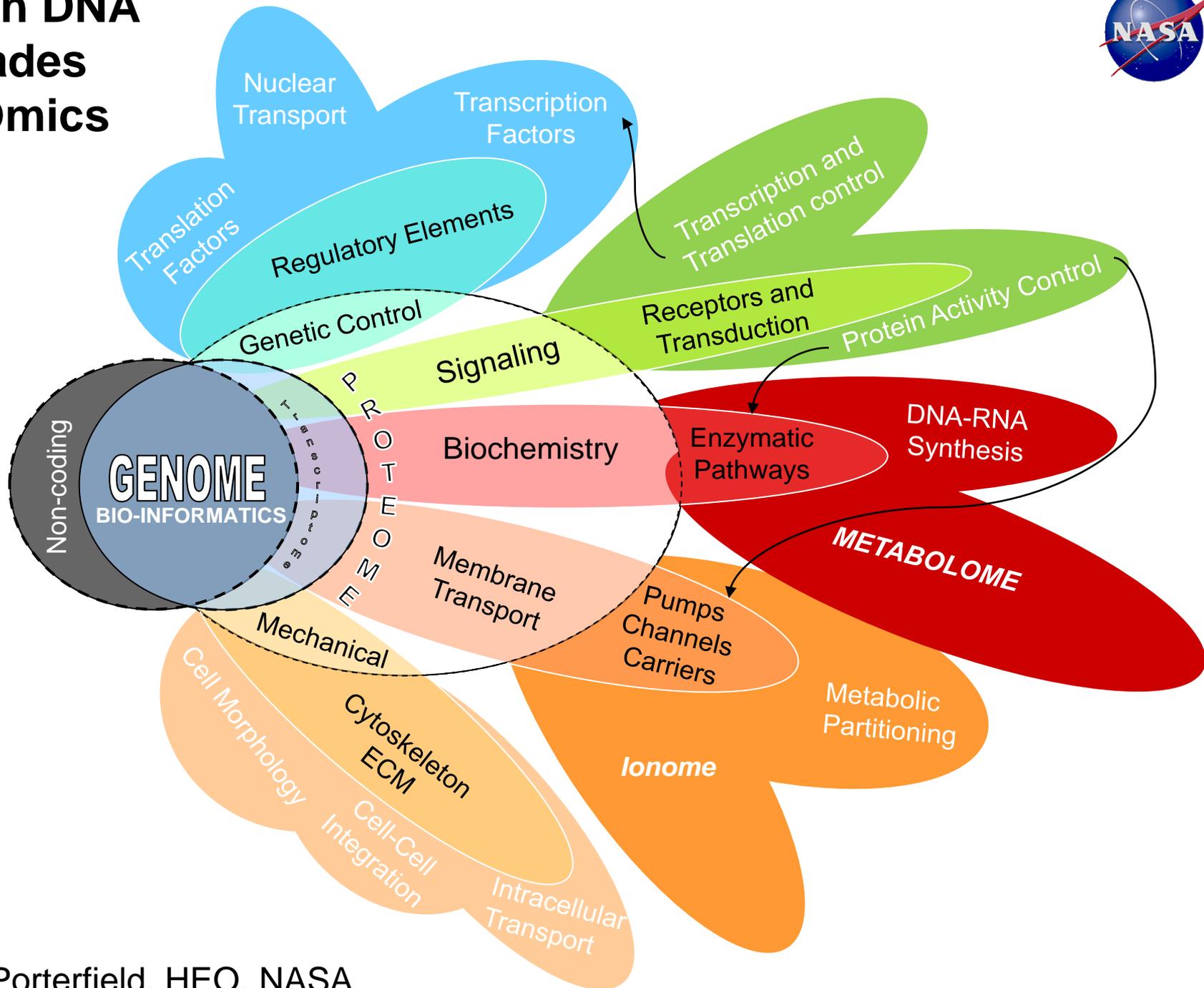
Space Life and Physical Sciences

geneLAB Project Formulation

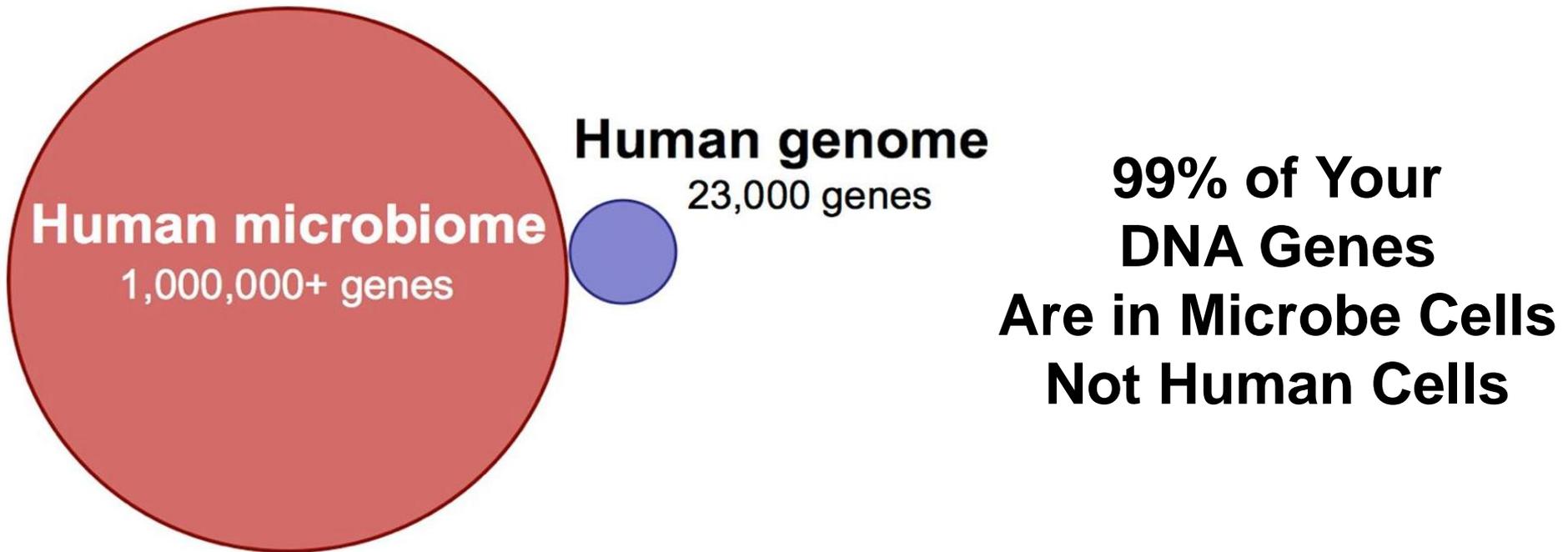
Marshall Porterfield, Division Director, HEO



Human DNA Cascades Into Omics



However, Your Body Has 10 Times As Many Microbe Cells As Human Cells!



**Inclusion of the Microbiome
Will Radically Change Medicine**



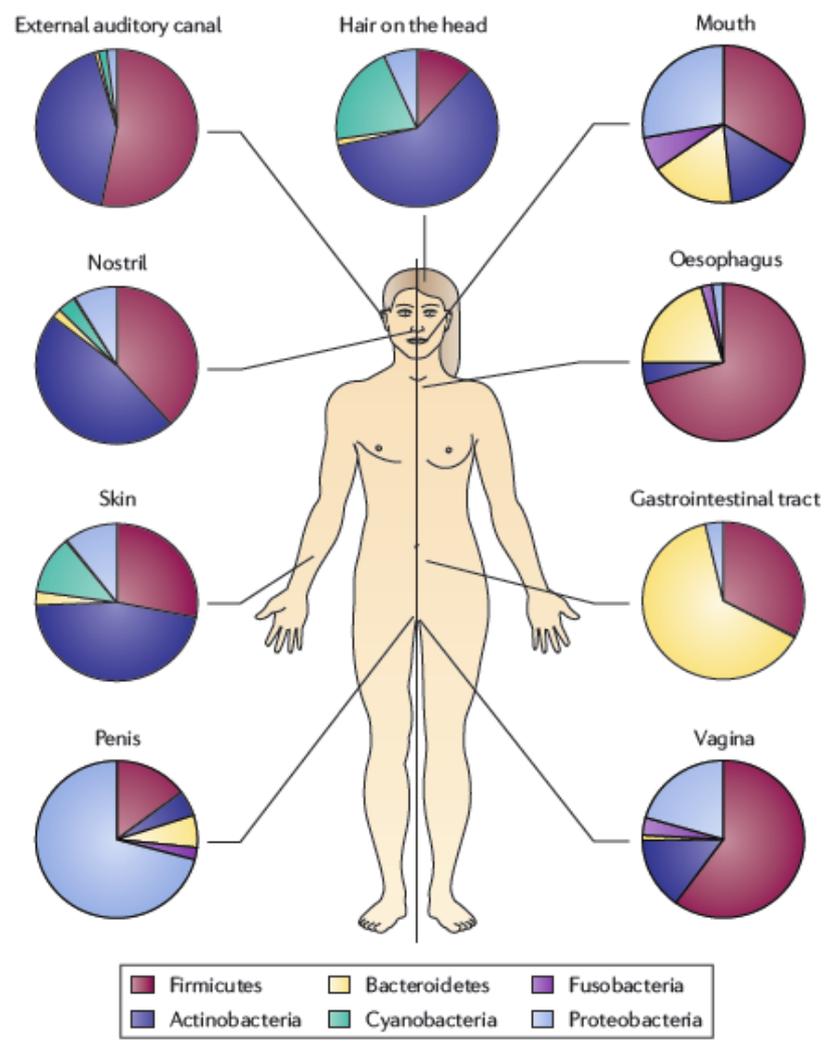
Quantifying the Human Superorganism: Distribution of Phyla of Microorganisms



Human Microbiome Project



Nature Reviews
Microbiology
v.9, p. 279 (2011)





From Omics Measurement to Results Is Highly Computationally Intensive

◆ ~180,000 Core-Hrs on Gordon

- KEGG function annotation: 90,000 hrs
- Mapping: 36,000 hrs
 - Used 16 Cores/Node and up to 50 nodes
- Duplicates removal: 18,000 hrs
- Assembly: 18,000 hrs
- Other: 18,000 hrs

◆ Gordon RAM Required

- 64GB RAM for Reference DB
- 192GB RAM for Assembly

◆ Gordon Disk Required

- Ultra-Fast Disk Holds Ref DB for All Nodes
- 8TB for All Subjects

SDSC



**Enabled by
a Grant of Time
on Gordon from SDSC
Director Mike Norman
to Larry Smarr**



J. Craig Venter™
INSTITUTE





One Year in Space

ISS Crew: Scott Kelly, Mikhail Kornienko Sign On For One-Year Mission

Posted: 11/26/2012 9:29 am EST Updated: 11/26/2012 9:40 am EST

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By: Tariq Malik

Published: 11/26/2012 08:12 AM EST on SPACE.com

A veteran NASA space commander and Russian cosmonaut have signed on for the ultimate space voyage: a yearlong trip on the International Space Station.

American astronaut Scott Kelly and Russian cosmonaut Mikhail Kornienko will launch on the [one-year space station flight](#) in spring 2015 and return to Earth in spring 2016, NASA officials announced today (Nov. 26). They will begin their mission training in early 2013.

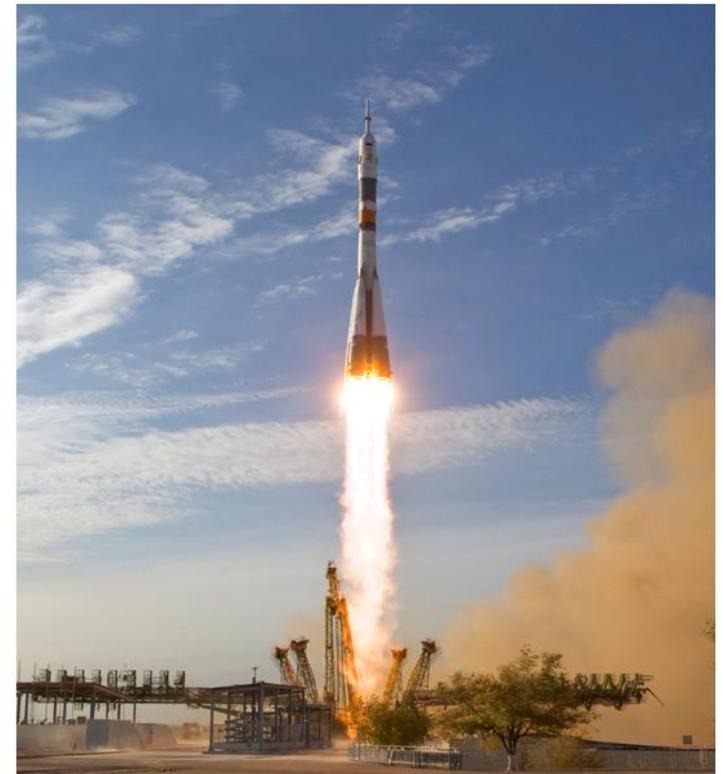
HOME > SCIENCE

Astronaut Scott Kelly Preparing for Unprecedented One Year in Space; Mission to Experiment on His Bone Mass, Vision, Immune System

By Latin Times Staff Writer, Dec 07, 2012 08:00 PM EST

0 Comments Like 0 Tweet 0 +1 0 Share Text Size - +

Tags: NASA, Space



Marshall Porterfield, HEO, NASA

1 Year Mission = Fantastic Opportunity to Perform Astro-Omics on Twins: Scott & Mark Kelly



Marshall Porterfield, HEO, NASA



Proposed Experimental Schema



Observe existing genetic differences between the twins

Confirm presence of existing genetic differences between the twins immediately prior to launch



ISS 2015



Observe genetic differences between twins following 1 year of spaceflight for Scott Kelly



Tuscon, AZ



Initial Baseline Phase
2013

Pre-Launch Phase
2014

In Flight Phase
2015

Post-Flight Phase
2016



BCM
Baylor College of Medicine

Center for Space Medicine

Marshall Porterfield, HEO, NASA

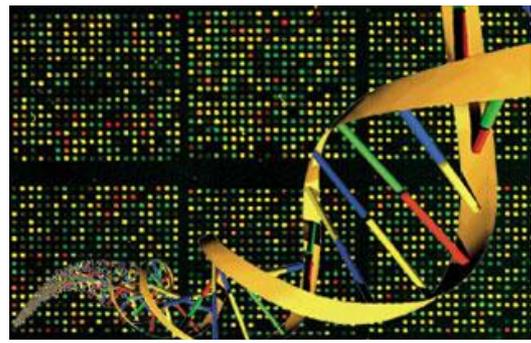
Sample @ 6 Hours, 3 weeks, 3, 6, 9 Months, and 51 Weeks into mission, (proposed)



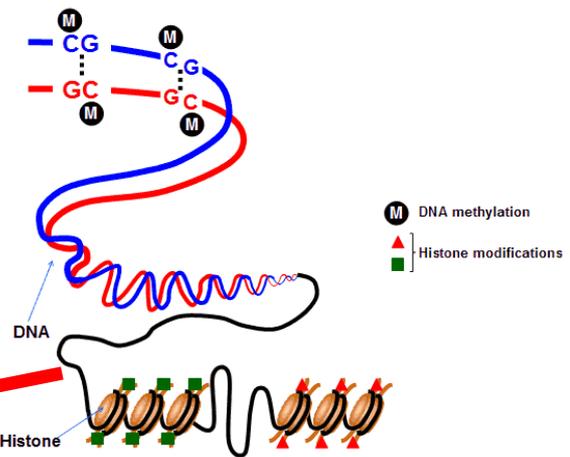
Perform Astro-Omics / Systems Biology



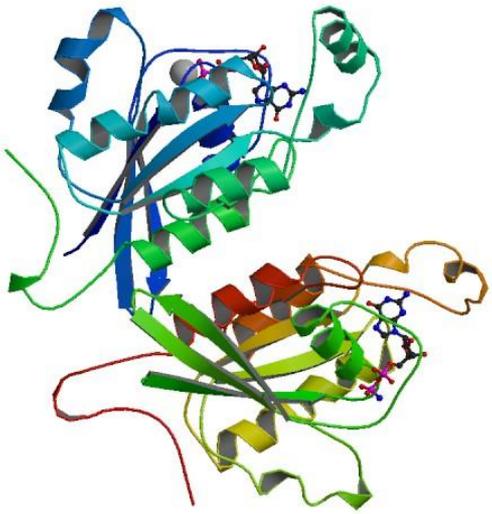
Genomics



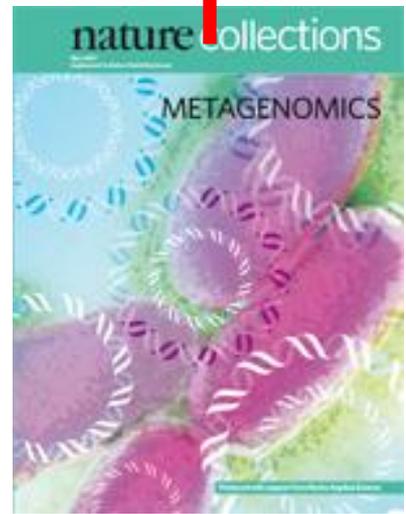
Transcriptomics



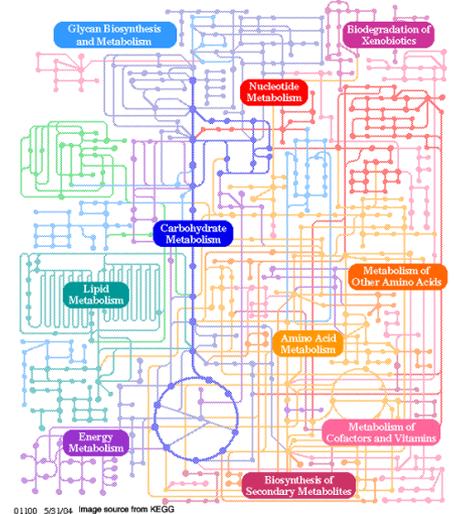
Epigenomics



Proteomics



Metagenomics



Metabolomics

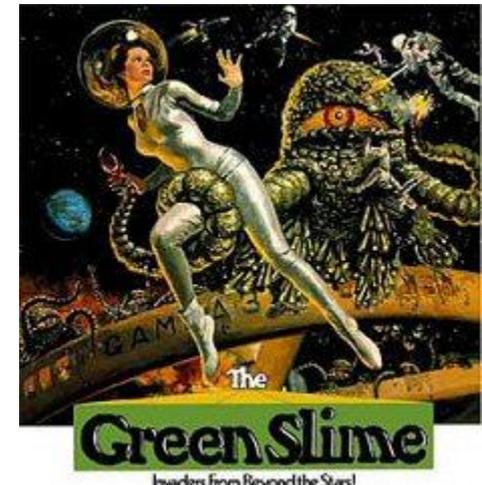
What Might We Learn?



Germs sent to space return 3 times as deadly

By Eric Berger | September 24, 2007 [Houston Chronicle](#)

"Space flight alters cellular and physiological responses in astronauts including the immune response," said ASU's Cheryl Nickerson, who led a project aboard NASA's space shuttle. "However, relatively little was known about microbial changes to infectious disease risk in response to space flight."





Questions?